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BIOLOGICAL EVALUATION OF INSECT DAMAGE AT THE INTERNATIONAL PAPER COMPANY, SPRINGHILL, LOUISIANA (1982)

by

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ABSTRACT

A seed orchard scouting program consisting of 9 visits was conducted during the 1982 growing season at the International Paper Seed Orchard, Springhill, Louisiana. Approximately 1,213 bushels of the 1983 cone crop were predicted to be present in the northern Louisiana loblolly seed source as of October 1982. This crop estimate represents the survival of 80% of the 1983 crop from March 1982 to October 1982. Insects were the major identifiable agents causing losses to both cones and conelets. Forest Pest Management (FPM) recommends that the 1983 pest management strategy should include a series of Guthion® 2S sprays applied via aircraft.

INTRODUCTION

A seed orchard scouting program was initiated during 1982. This scouting program was designed to:

1) quantify the losses attributed to the major mortality agents
2) determine the periods when major mortality occurs
3) determine the effect these losses will have on the projected cone crop
4) identify areas where modification could be made to the current pest management strategy to better respond to pest pressures.

A scouting crew from Forest Pest Management (FPM), Alexandria Field Office, monitored damage incidences and pest populations from March to October 1982. During these visits data were compiled confirming that insects are the major identifiable agents causing losses in seed orchards (Overgaard et al. 1974) and, if not controlled, insect pests will

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adversely affect the availability of superior pine seed, thereby reducing future timber production (Barber 1982). Because there continues to be a demand for loblolly seed, personnel from International Paper are interested in maximizing seed production. Based upon the results of these evaluations, FPM recommends that a series of Guthion® 2S sprays be applied via aircraft.

METHODS OF EVALUATING INSECT POPULATIONS AND LOSSES

Pest management decisions are dependent upon accurate predictions and assessments of crop production levels (I), pest population levels (II), and associated damage levels (III). Three inventory-monitoring systems were implemented to quantify this information.

I. Cone and Seed Inventory-Monitoring System (Bramlett and Godbee 1982)

A. Selection of inventory trees

Sixteen clones, in the northern loblolly seed sources were selected as inventory clones. Eight clones were selected from the high production class, 5 clones were selected from the medium production class, and 3 clones were selected from the low production class. Three ramets were sampled from each of the inventory clones. The table below lists the selected clones, the number of ramets sampled, and the number of ramets of each clone within the northern loblolly seed sources.

Clone	Production Classes					
	High		Medium		Low	
	No. Ramets (Sampled)	No. Ramets (Orchard)	No. Ramets (Sampled)	No. Ramets (Orchard)	No. Ramets (Sampled)	No. Ramets (Orchard)
AR-2			3	37		
AR-3	3	30				
BR-4	3	85				
BR-6	3	36				
BR-9	3	74				
BR-14			3	34		
MA-1	3	61				
NA-4			3	20		
OU-4					3	36
OU-5					3	29
RI-1	3	66				
RI-2	3	70				
RI-4					3	36
RI-5			3	43		
SH-2			3	61		
SH-4	3	22				
TOTAL	24	444	15	195	9	101

Samples were taken from ramets of 100% of the high producing clones, 38% of the medium producing clones, and 30% of the low producing clones.

B. Inventory procedures

Prior to conelet closure, all of the female flowers within 1/2 of the tree crown were estimated. This number was doubled and entered on the data sheet as a total tree count.

Eight branches per ramet were tagged with aluminum tags (numbered 1-8) and orange flagging. The number of female flowers and 2nd year cones found on each tagged branch was recorded. These tagged branches were resampled in April, June, August, and October 1982 to obtain survival estimates. If a tagged branch no longer contained any flowers or cones, the tag was removed.

II. Pest Population Inventory-Monitoring System

The following are key insect pests causing flower, conelet, and cone damage to loblolly seed source.

Leptoglossus corculus (Say)	Leaffooted pine seedbug
Tetyra bipunctata (H.-S.)	Shieldbacked pine seedbug
Dioryctria merkeli Mutuura & Munroe	Loblolly pine coneworm
Dioryctria amatella (Hulst)	Southern pine coneworm
Dioryctria clarioralis (Walker)	Blister coneworm
Dioryctria disclusa Heinrich	Webbing coneworm
Family Cecidomyiidae	Cone feeding midges

Currently there are no techniques to predict population trends for any of these pests. A few techniques are available which can detect the presence of certain pests.

A. Pheromone trapping for Dioryctria spp.

Pheromone trapping techniques are available for 4 coneworm species, D. disclusa, D. clarioralis, D. merkeli, and D. amatella. Because pheromone trapping for these species is a relatively new technique, a standardized trapping scheme has not been developed. In the interim, Forest Service Research recommended using 10 Pherocon 1C® traps per pheromone. Traps were hung with a pulley system from an upper limb located within the top 10 feet of the crown. Twice a week orchard personnel checked the traps and recorded the number of male moths. Baits were changed monthly.

B. Visual searches for Leptoglossus corculus and Tetyra bipunctata

Attractive trapping methods are not available for either species of seedbug commonly found in seed orchards. Beginning in late March, visual searches were made of all branches sampled during the cone and seed inventory-monitoring system. The number of seedbugs sighted was recorded.

III. Impact Inventory-Monitoring System

Data were gathered, which were used to generate impact estimates, by identifying causes of mortality for cones and conelets inventoried in the cone and seed inventory-monitoring system.

RESULTS AND DISCUSSION

Based upon the cone and seed inventory-monitoring system, approximately 1,213 bushels of cones (potential 1983 crop) are currently on the trees. This estimate represents the survival of 80% of the original estimate made in March 1982. Predictions based on a generalized survival curve indicate that approximately 912 bushels of northern loblolly should be harvested in October 1983. Table 1 summarizes these predictions for the 1983 crop.

The following assumptions were used to predict the size of the 1982 cone crop.

1. Sample ramets are representative of all of the ramets of the selected clones.
2. Selected clones represent production levels of unsampled clones.
3. One bushel contains 350 cones.
4. One pound of seed can be extracted from a bushel of cones.
5. Potential estimates are based on the survival of 100% of the flowers or cones from each visit until harvest.
6. Predicted estimates are based on a generalized curve which predicts the crop size expected at maturity when mortality is considered (Bramlett 1982).

The orchard production in bushels of cones for the 1983 cone crop is illustrated in figure 1. The dashed line on the graph represents the generalized curve compiled by Bramlett and Godbee (1982) for cone survival in a moderately managed orchard. The solid line represents the actual cone survival based upon periodic observations of tagged branches.

Assessment of Key Pest Populations and Impacts

A. Coneworms

Species - *Dioryctria amatella* - southern pine coneworm
D. clarioralis - blister coneworm
D. disclusa - webbing coneworm
D. merkeli - loblolly pine coneworm

Pest Status - In the western zone of the Southern Region, greatest losses due to coneworms are attributed to *D. amatella* and *D. clarioralis*. These pests have multiple generations per year and, therefore, the potential exists for population buildup during the season. In certain orchards spectacular losses have been caused by *D. disclusa*, a single generation pest.

Table 1. Estimation, based on the inventory-monitoring system, of 1983 northern loblolly cone crop.

Date	No. Cones	Bushels of Cones	Lbs. of Seed
March 1982			
Potential	531,829	1,520	1,520
Predicted	319,200	912	912
May 1982			
Potential	464,872	1,328	1,328
Predicted	276,500	790	790
June 1982			
Potential	450,182	1,286	1,286
Predicted	292,600	836	836
August 1982			
Potential	446,872	1,277	1,277
Predicted	313,880	897	897
October 1982			
Potential	424,546	1,213	1,213
Predicted	319,200	912	912

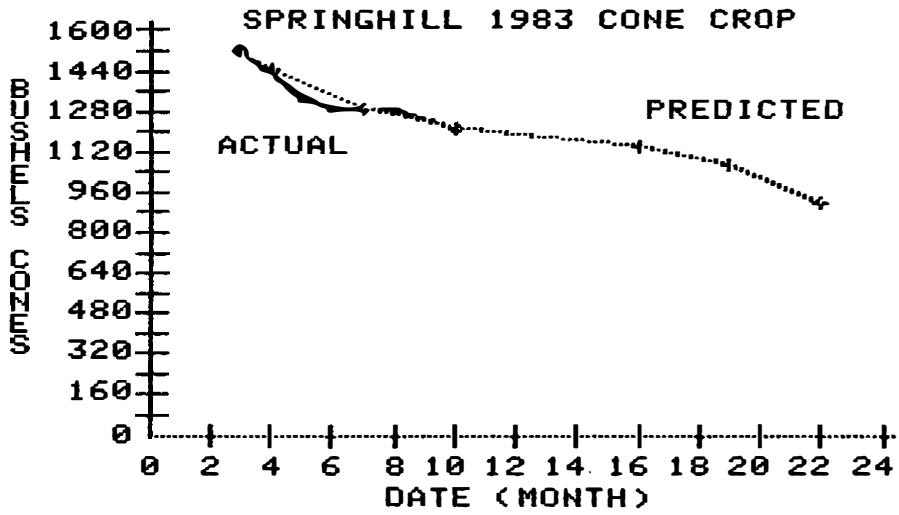

Figure 1. Survival curve of the 1982 cone crop estimated from the cone and seed inventory-monitoring system

The pheromone trap catches (figure 2) reveal that D. disclusa populations are minimal, while D. amatella, D. clarioralis, and D. merkeli populations are potentially damaging.

At the Springhill Seed Orchard, shoot attacks may be the earliest visible coneworm damage found during the spring. These attacks are usually attributed to D. merkeli, the loblolly pine coneworm, which has only one generation a year. After overwintering as small larvae, they move from shoots and flowers to cones. The larvae remain inactive throughout the summer, pupating and emerging in the fall. Based upon the 1982 pheromone survey, D. merkeli was a key pest species. Orchard personnel should be constantly alert to any unusual increase in dying tips or small dead cones which do not show any evidence of webbing.

Another species which has not reached pest status at the Springhill Seed Orchard is the webbing coneworm, D. disclusa. Trap catches during the 1982 flight were low. Therefore, it is unlikely that major losses will occur in 1983. This species overwinters as a small larva and can be found in the male catkins in the spring. If populations are large, webbing becomes very noticeable within the catkins. When the catkins are dry, the larvae migrate to the 2nd year cones, often before control programs have begun. The cones die prior to elongation, and webbing and frass are present surrounding the entry hole.

Dioryctria clarioralis, another key pest species, overwinters as a large larva and does little or no damage prior to pupating in the early spring. The first blister coneworm flight occurred from April 19 to May 13, peaking on April 19. The 2nd and 3rd flights of D. clarioralis were not detectable. Based upon the number of moths trapped during the first flight, a sizeable population evidently overwintered from the fall population of 1981. Between the May and June inventories, coneworm losses on 2nd year cones increased from 1.00% to 17.00% (table 2). However, D. clarioralis populations, as detected by the pheromone traps, did not appear to build during the 2nd generation. This may be a result of trapping inefficiency during the hottest part of the summer. In most of the orchards where the pheromone survey is being utilized, spring and fall peaks of the key pests are usually detectable. At the Springhill Orchard, a sizeable spring peak of D. clarioralis was detected, but a fall peak did not occur. Hopefully, the pest management actions taken in 1982 suppressed the D. clarioralis population to tolerable levels.

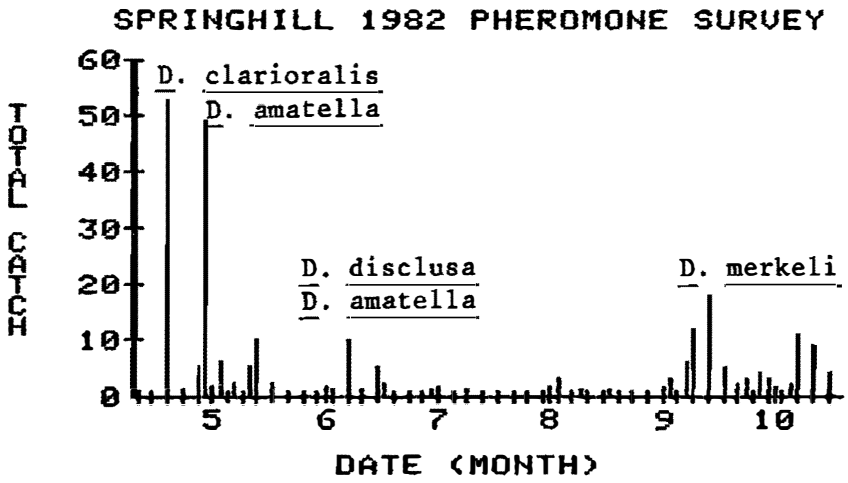

Figure 2. Frequency histogram of the pheromone trap catches of 4 coneworm species (1982)

Table 2. Summary of cone mortality of the 1982 northern loblolly cone crop.

Mortality Agents	No. of Dead Cones		% Mortality	
March - May 1982				
Coneworm Damage	3		1.00	
Unknown	2		0.67	
Unknown Damage	1		0.33	
TOTAL	6		2.00	
May - June 1982				
Coneworms	50		17.00	
D. amatella		18		6.14
D. clarioralis		17		5.80
Missing	3		1.02	
Unknown	3		1.02	
TOTAL	56		19.04	
June - August 1982				
Coneworms	37		15.88	
Coneworm Damage		22		9.44
TOTAL	37		15.88	
August - October 1982				
Coneworms	24		12.24	
Coneworm Damage		4		2.04
Unknown	3		1.53	
Unknown Damage	1		0.51	
Missing	1		0.51	
TOTAL	29		14.79	

Dioryctria amatella, the southern pine coneworm, overwinters as an early instar larva and begins feeding on male and female flower buds. Later these larvae migrate to shoots or young 2nd year cones where they pupate and emerge. The early damage caused by coneworms to 2nd year cones (1.00%) detected in May probably resulted from feeding of the overwintering D. amatella larvae. The first generation moth flight was detected by the pheromone traps on April 19 to May 17 with peak catch on April 29. Trap catches of D. amatella occurred sporadically in June, August, and September.

Coneworm damage occurred throughout the summer. The coneworm caused losses peaked between May and June (table 2). This early peak resulted from damage caused by D. merkeli, D. clarioralis, and D. amatella. After August, damage levels declined slightly but continued above acceptable levels until harvest in October. No additional damage caused by D. merkeli occurred after June, therefore, late season damage probably resulted from D. clarioralis and D. amatella.

B. Seedbugs

Species - Leptoglossus corculus (Say) - leaffooted pine seedbug
Tetyra bipunctata (H.-S.) - shieldbacked pine seedbug

Pest Status - The sizes of seedbug populations vary widely among seed orchards. Populations of leaffooted pine seedbugs are considered to be more destructive than populations of shieldbacked pine seedbugs. Significant numbers of overwintering adult leaffooted pine seedbugs were observed in May. By April the L. corculus populations seemed to have disappeared. In August T. bipunctata was the more prevalent species. Visual estimates of seedbug populations are generally conservative because of the secretive behavior of seedbugs.

The impact seedbugs will have upon the seed crop will be covered in the post-treatment report.

It is suspected that some of the unknown and missing conelet losses (table 3) found between March and May were caused by seedbug feeding. The greatest conelet losses, 12.17%, occurred during the March to May interval. After May, conelet losses remained at or below 5%.

Table 3. Summary of conelet mortality of the 1983 northern loblolly cone crop.

Mortality Agents	No. of Dead Conelets		% Mortality	
March - May 1982				
Missing	30,567		5.69	
Unknown Insects	19,352		3.60	
Unknown	13,241		2.46	
Coneworms	2,241		0.42	
Coneworm Damage		1,932		0.36
Shoot Attacks		1,556		0.29
TOTAL	65,401		12.17	
May - June 1982				
Coneworms	5,562		1.20	
D. clarioralis		3,609		0.78
D. amatella		41		0.01
Shoot Attacks		337		0.07
Missing	7,481		1.63	
Unknown	3,435		0.74	
Unknown Insects	3,410		0.73	
TOTAL	19,888		4.30	
June - August 1982				
Missing	3,959		0.88	
Coneworms	2,080		0.46	
D. clarioralis		508		0.11
Pitch Canker	362		0.08	
Unknown	86		0.02	
TOTAL	6,487		1.55	
August - October 1982				
Unknown	9,110		2.04	
Missing	5,768		1.29	
Coneworms	4,800		1.07	
Unknown Insects	1,793		0.40	
Man	996		0.22	
TOTAL	22,467		5.02	

C. Other pests

No other pests were found in numbers expected to cause damage.

RECOMMENDATIONS

Conelet mortality in 1982 (16%) was similar to the mortality predicted by the generalized survival curve (Bramlett and Godbee 1982). Therefore, the 1983 northern loblolly cone crop is expected to average approximately 900 bushels. In order to realize this production goal, the 1983 pest management program must keep cone losses to a minimum. FPM recommends that the 1983 pest management strategy should consist of a series of Guthion 2S sprays (see Appendix I, Alternative 4), applied via aircraft.

In 1982 coneworms were the key pests of 2nd year cones. Assuming that the same species causing damage in 1982 continue to cause losses in 1983, FPM recommends using the 1982 pheromone survey data to adjust application dates. Figure 3 superimposes the suggested spray application dates on the 1982 pheromone survey histogram. Based upon this information, FPM recommends a maximum of 5 sprays. The following calendar lists the approximate spray schedule.

Application	Date
1	10-15 days after peak pollen shed
2	Mid May
3	*Mid June*
4	*Mid-late August*
5	Mid-late September

If pest populations are low during mid summer, the applications printed in italics could be eliminated. FPM will continue to assist seed orchard personnel in monitoring damage levels, particularly in late May and early June. If cone losses during this period are less than 5%, FPM will recommend that sprays 3 and 4 be eliminated.

FPM is recommending that Guthion 2S be applied at a rate of 2 lbs. of active ingredient per acre by aircraft. Suggested application specifications for fixed-wing and helicopter are listed below.

Parameter	Helicopter	Fixed Wing
Droplet size VMD (microns)	300-350	300-350
Nozzles	50 (D-02-25)	30 (D-06-46)
Boom Pressure (PSIG)	40	40
Speed (MPH)	25	90
Swath Width (ft.)	30	30
Release height above trees (ft.)	5	5
Adjuvant - Nalco-Trol®	3 oz/100 gal H_2O	3 oz/100 gal H_2O

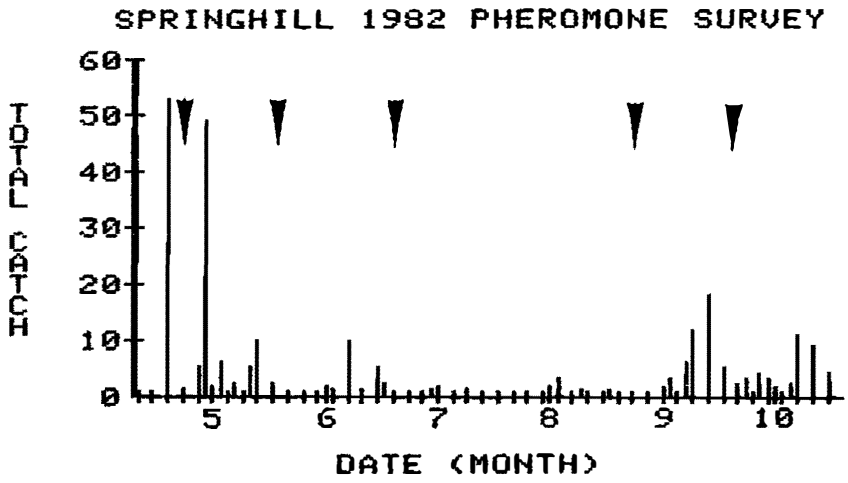

Figure 3. Frequency histogram of the pheromone trap catches with suggested application dates (◄)

Our experience has shown that many aerial applicators can apply the insecticide with a 60 ft. swath. We have no reason to suspect that an increase in swath width should adversely affect the coverage.

If the Springhill Orchard finds that Alternative 4 with aerial application does not meet their needs, FPM recommends the following alternatives in the order listed.

1) Alternative 4 - Replacing aerial with mistblower application
2) Alternative 6 - Aerial application
3) Alternative 6 - Ground application

Appendix I describes suggested control alternatives.

APPENDIX I

SEED ORCHARD PEST MANAGEMENT CONTROL ALTERNATIVES

Alternative 1. No action.

Benefits:

1) Lowers management costs
2) Encourages the natural buildup of beneficial insects and other predators
3) Reduces exposure of personnel to pesticides
4) Discourages the development of resistant strains of pests

Detriments:

1) Losses must be tolerated for indefinite periods of time
2) Pest populations may build to levels which cannot be tolerated before beneficial insects check the increase

Rationale: This alternative is usually selected when the value of the existing crop is less than the cost of the most inexpensive chemical control measure. As second generation orchards begin producing and as superior seed becomes available in storage, 1st generation orchards, or blocks within these orchards, may be placed on low maintenance. Under a low maintenance program, the "No Action" alternative will become an integral component.

Currently this option is of limited value. Young orchards which have not experienced pest population buildups are probably more efficiently managed without a structured spray program. Very few managers of producing orchards consider this a viable alternative.

Alternative 2. One Furadan® application.

Benefits:

1) Targeted at pests which feed on pine, not at beneficial insects
2) One application may reduce pest populations for several months

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) High cost for a single application

3) Translocation is dependent upon adequate soil moisture
4) Efficacy decreases by midsummer
5) Application must be made in late winter or early spring when the ground is frozen or wet

Rationale: This alternative is usually considered for fairly well-drained orchards. Many orchards across the Southeast are too wet in late winter, and the application must be delayed. Applications made after mid-February will not effectively control early season pests. Apparently Furadan provides better protection of conelet crops than it does cone crops. If the flower crop is the featured crop, then a single Furadan application may be an effective strategy.

Orchard managers who have chosen this single application strategy must be willing to accept late season losses.

Alternative 3. Split Furadan application.

Benefits:

1) Targeted at pests which feed on pine, not at beneficial insects
2) One application may reduce pest populations for several months
3) Allows for flexibility in determining when Furadan will be effective

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) High application and chemical cost
3) Translocation is dependent upon adequate soil moisture
4) Applications may be delayed because of ground conditions

Rationale: This alternative is usually considered in the same orchard where a single Furadan application would be effective. The treatments should be made approximately 6 weeks before the targeted pests are active or before the previous Furadan concentrations have dropped below the lethal concentration (LC). This alternative may allow you to extend the protection associated with Furadan throughout the growing season. In theory, this alternative has potential. However, the inconsistencies associated with Furadan uptake and translocation probably will make the double application even more inconsistent.

Timing is an important consideration. If the first application is targeted for early season pests, then the standard mid-February application will probably be timely for this first application. Furadan usually dissipates by mid to late summer. Therefore, a second application should be applied in late May or early June.

The 2nd important consideration is the application rate. The current label allows for application of from 4-8 oz. of Furadan 10G for each inch of tree diameter. In a split application, two 4 oz. applications should be effective if uptake is sufficient.

Preliminary results indicate that split applications of Furadan used alone do not adequately increase protection over a single application (Overgaard 1976). Additional modifications could be considered but the most important consideration is the benefit:cost of 2 applications as opposed to a single application.

Alternative 4. Three to six sprays of Guthion® or Pydrin®.

Benefits:

1) Multiple sprays allow flexibility in timing applications
2) Frequency of applications can reflect insect damages and/or population levels
3) Flexibility in method of application (ground, air)

Detriments:

1) Labor intensive
2) Excessive exposure of personnel to restricted use pesticide
3) Ground applications may be delayed by excessive soil moisture
4) Residuals from foliar applications are affected by rainfall

Rationale: This alternative allows more responsiveness to insect population levels and flexibility in targeting an application to coincide with the life cycle of the pests. Guthion and Pydrin are the only chemicals currently registered for coneworm control which can be applied monthly, throughout the summer, at the recommended rates. The most widely used formulation of Guthion is the 2S formulation. The 2S formulation does not crystalize when stored below freezing. In addition, the 2S formulation as compared with the WP formulation can be applied with less wear to spraying equipment. However, the WP formulation has a longer residual than the 2S formulation. It may be advantageous to utilize the advantages of each

formulation and use the WP formulation in spring when rainfall is heavy, switching to the less abrasive formulation in the summer and fall. Pydrin is a synthetic pyrethroid with a low mammalian toxicity. Exposure of orchard personnel to Pydrin is much less hazardous. In addition, Pydrin remains at effective concentration for longer periods than Guthion 2S.

The application schedule is extremely important. Applications should be made just prior to the periods when the greatest damages occur. The first spring application usually is made during the week following pollination. This application coincides well with the period when major conelet losses occur and when early coneworm caused losses are beginning. Subsequent sprays are often applied at monthly intervals following the initial spray. If the orchard manager has adequate information to identify and monitor the key pests, then the applications can be targeted for the susceptible stages of the key pests. Currently the technology to monitor and time sprays is limited.

Alternative 5. Furadan combined with supplementary sprays.

Benefits:

1) Insures the orchard is protected during the entire season
2) Increases the suppression efforts against coneworms
3) Early spray applications serve as a backup to Furadan if uptake is minimal

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) Translocation is dependent upon adequate soil moisture
3) Application must be made in late winter or early spring when the ground is frozen or wet
4) Labor intensive
5) Ground applications may be delayed by excessive soil moisture
6) Pest management costs are increased substantially
7) Residuals from foliar applications are affected by rainfall

Rationale: This alternative is becoming increasingly popular with industrial orchards. Often the size of the area to be treated is the limiting factor.

If Furadan uptake is sufficient, conelet survival is increased substantially. The highest Furadan concentrations are usually found in the actively growing shoots, making Furadan an ideal

pesticide for early season shoot infesting pests such as tip moths. Furadan appears to be less effective against coneworms, damaging 2nd year cones. Therefore, backup sprays increase the suppression efforts targeted for coneworm control. Both pesticides are usually effective against seedbugs.

The major concern when choosing this alternative is timing the supplementary sprays to obtain maximum protection for the increased management costs. If the orchard has a history of early season pests, particularly 1st generation coneworms (Dioryctria disclusa, etc.), it may be desirable to apply a pesticide 6 days after peak pollen flight. Beginning in mid-May or early June, 2 to 4 additional sprays should protect 2nd year cones against increasing coneworm populations. If cones are harvested using the traditional hand picking procedures, the last spray would probably be applied 2 or 3 weeks before harvest. If netting is used to harvest seed, the last spray can be delayed to suppress increasing populations of both seedbugs and coneworms.

The choice of insecticides is limited. Currently 2 insecticides, Pydrin and Guthion, are registered for coneworm and seedbug control. Pydrin is an ideal chemical for spray applications during periods when orchard personnel are active within the orchard and during periods when a longer residual is needed. Therefore, spring and fall would be ideal times for Pydrin applications while Guthion might be applied in midsummer. This combination of insecticides, Furadan, Guthion, and Pydrin, should help eliminate many of the sucking insect problems associated with the use of Pydrin and Guthion applied by aerial application.

Alternative 6. Three to six sprays of mixed chemicals.

Benefits:

1) Multiple sprays allow flexibility in timing applications
2) Frequency of applications can reflect insect damages and/or population levels
3) Flexibility in method of application (ground, air)
4) Decreased potential for resistant pest populations
5) Less exposure to highly toxic chemicals

Detriments:

1) Labor intensive
2) Excessive exposure of personnel to restricted use pesticide

3) Ground application may be delayed by excessive soil moisture
4) Residuals from foliar applications are affected by rainfall

Rationale: This alternative is very similar to Alternative 4. It is usually advantageous to alternate chemicals rather than to depend on one chemical. Alternate applications of chemicals, with different modes of actions, tend to decrease the development of resistant pest populations. Currently, Pydrin and Guthion are the two registered chemicals which fit well into a spray schedule. Hydraulic, mist blower, and aerial applications of both chemicals have been demonstrated to effectively suppress coneworm and seedbug populations. The characteristics of each chemical have been described under the rationale section of Alternative 5. These characteristics should help determine when each chemical should be applied.

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PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in their original containers under lock and key out of reach of children and animals, and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear appropriate protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agent, state extension specialist or FPM to be sure it is still registered for the intended use. For further information or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).

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BIOLOGICAL EVALUATION OF INSECT DAMAGE AT THE INTERNATIONAL PAPER SEED ORCHARD, SPRINGHILL, LOUISIANA (1982)

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